CONFIDENTIAL

file: Delay Actuator
A.C. Delay MK II

PROGRESS REPORTS

FOR

NOVEMBER 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

MAY 59 THRU NOV 59

21 December 1959

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During November cycling tests were completed on eighteen capsules equipped with .002" thick brass closures. This cycling test included an average of three cycles a day for thirty days. The items had been transferred rapidly from an oven at 120°F to a deep freeze chest at -60°F. This method added an exposure to thermal shock as well as temperature differential.

Thirty days of this treatment failed to disclose any significant loss in weight by any capsules except those two items having a copper closure instead of brass.

Tooling is now being made for drawing enough closures to complete at least two hundred complete capsules enclosing samples of all the solvents used in the delay kits.

It is planned to test these completed capsules for leakage and surveillance characteristics.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,955.00
Expenditures for November 1959	561.77
Total Expenditures to 30 November 1959	2,100.21
Balance of Contract	854.79

Expiration Date: 18 January 1960

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file : Delay
Activator, A-C. Delay
MK II

PROGRESS REPORT

FOR

OCTOBER 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

1 December 1959

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Work on the Capsule Study during October was directed toward the development of a more effective seal for the operating end of the solvent capsule.

In view of the fact that lead had shown rather poor surveillance properties and that glass discs were found difficult to seal, brass was the next material investigated.

A number of brass discs were cut from .002 thick shim stock and, after annealing, were soldered to the open end of brass capsules. These were found to be rather difficult to solder in place so the same material was used to draw thin brass cups of approximately the same design as the present lead closures.

By coating the mating surface of the capsule body with solder, the brass closure was found to slip on easily and accept solder quite readily.

The thin brass closure was found to make an effective seal when attached by ordinary soldering methods and to retain the contents of the capsule under a wide range of temperatures.

In order to perforate the capsule when the delay device was actuated, a slight modification of the top of the retainer was necessary. It was found that by counter boring the top of this retainer, a sharp annular cutting edge could be formed on the top surface which was sufficient to cut to open the capsule. With this modification, it was found possible to cut a circular opening in the brass closure with a moderate effort by the operator. A torque of 15 inch pounds was the measured force

required to actuate the delay. After successfully fabricating the brass closures and modifying a number of retainer bushings, a number of capsules were made and tested. Eight capsules were filled with acetone and eight were filled with acetone and eight were filled with butyl lactate and sealed as above. In addition, two more capsules were sealed with .005" thick drawn copper closures.

These capsules were exposed to 120°F in an oven for several hours and then plunged into a freezer at -60°F. This cycle was performed about three times a day or fifteen times a week and is still proceeding.

After two weeks the repeated weighing of the capsules indicated that the copper closures were permitting the escape of solvent while the capsules with the brass closures showed no significant loss in weight.

The cycling will be continued for at least a month.

Work is proceeding on the design of tooling for drawing the brass closure cups. It is planned to change from brass shim stock, which has a directional grain, to cartridge brass in order to obtain an even more uniform cup.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,935.00
Expenditures for October 1959	605.70
Total Expenditures to 31 October 1959	1,538.44
Balance of Contract	1,396.56

Expiration Date: 18 November 1959

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PROGRESS REPORT

FOR

SEPTEMBER 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

26 October 1959

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During August and September the problem of sealing the capsules against solvent loss was approached from the aspect of both design and material.

Several cylindrical aluminum cups were made of such size that a standard 18 mm cover glass could be used as rupture discs. A shallow recessed seat in the open end of the cup permitted the glass disc to rest firmly on metal with space above it for the application of cement.

The aluminum capsule body was then filled with acetone and the disc sealed in place. A modified epoxy resin was tried first but failed to prevent the acetone from seeping under the edge of the glass disc. Ceramic cements presented the same problem as they became porous upon hardening.

None of the cemented glass discs were found capable of restraining the acetone vapor when exposed to 120°F in an oven.

A suggestion was considered of designing an all glass capsule with the lower end open so as to permit a thin glass disc to be heat sealed in place to serve as a rupture plate.

It was felt that since a capsule of this nature would involve other changes in design, it might be better to explore other possibilities which would cause fewer complications.

An aluminum capsule body was made with a somewhat deeper recessed seat in the open end. The wall above the seat was threaded so that the disc could be secured in place by a threaded retaining ring. The disc was cushioned by an O-ring above and below the glass in order that the retaining ring could be screwed down firmly enough to make a leak-proof seal. Unfortunately, the O-ring material exhibited a tendency to swell from contact with the solvent in the capsule. Since this swelling might cause

surveillance problems, further capsule designs were considered.

The next line of approach will be an attempt to use a thin metal disc cut from some material such as brass shim stock or copper sheet which can be soldered in place on the present brass capsule body in the same manner as the original lead disc. Some cutting arrangement may be provided which will not require any extensive changes in the delay mechanism.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,935.00
Expenditures for September 1959	361.00
Total Expenditures to 30 September 1959	932.74
Balance of Contract	2,002.26

Expiration Date: 18 November 1959

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file: Delay Actuator
A.C. Delay MK II

PROGRESS REPORT

FOR

JULY 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

1 September 1959

CONFIDENTIAL

Completion of solubility tests on Delrin using the same series of solvents as was used on Teflon and Kel-F indicated no appreciable lowering of absorption properties. It should be noted that the tests as performed take into account mainly solubility and absorption, but do not present a complete picture of the vapor transmission properties of the several plastics under consideration.

Several redesign possibilities were considered involving the use of metal cups having a rupture disc fixed in the lower end by means of an impervious seal. This disc (of thin glass) would avoid the problem of pin holes, but might present difficulties in sealing. This will be investigated as soon as glass discs of special size can be procured.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,935.00
Expenditures for July 1959	270.19
Total Expenditures to 31 July 1959	571.74
Balance of Contract	2,363.26

Expiration Date: 18 November 1959

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file: Delay Actuator
A.C. Delay MK II

PROGRESS REPORT

FOR

JUNE 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

28 July 1959

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Completion of the preliminary solubility tests on Teflon and Kel-F during the month of June 1959, indicated no appreciable effects at ambient temperatures over a period of thirty days. At elevated temperatures (250°F) for one week, both Teflon and Kel-F showed slight increases in weight after exposure to n-butyl acetate and iso-amyl acetate. N-butyl lactate produced the highest increase in weight both at ambient and elevated temperatures.

In view of possible surveillance problems, further investigation is being conducted to find a material with more favorable resistance to solvents. Delrin, an acetal resin produced by DuPont, is currently being tested for resistance to solvents.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,955.00
Expenditures for June 1959	301.55
Expenditures to 30 June 1959	301.55
Balance of Contract	2,653.45

Expiration Date: 18 November 1959

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File - ED-183B
Delay Actuator, A.C. Delay MK II

PROGRESS REPORT

FOR

MAY 1959

ON THE

CAPSULE STUDY

RD 45, TASK ORDER R

WORK ORDER 9

25 June 1959

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Samples of Kel-F and Teflon were obtained in May and preliminary solubility tests were set up to determine the compatibility between these resins and the various solvents involved.

The solvents used in this test are acetone, n-butyl acetate, n-propyl acetate, iso-amyl acetate, di-methyl phthalate, ethyl lactate and n-butyl lactate.

These tests are now proceeding at normal ambient conditions but will be repeated at elevated temperatures in order to determine the effect of temperature on the solubility or swelling of these resins.

FINANCIAL STATEMENT

Total Amount of Contract	$ 2,955.00
Expenditures for May 1959	none
Total Expenditures to 31 May 1959	none
Balance of Contract	2,955.00

Expiration Date: 18 November 1959